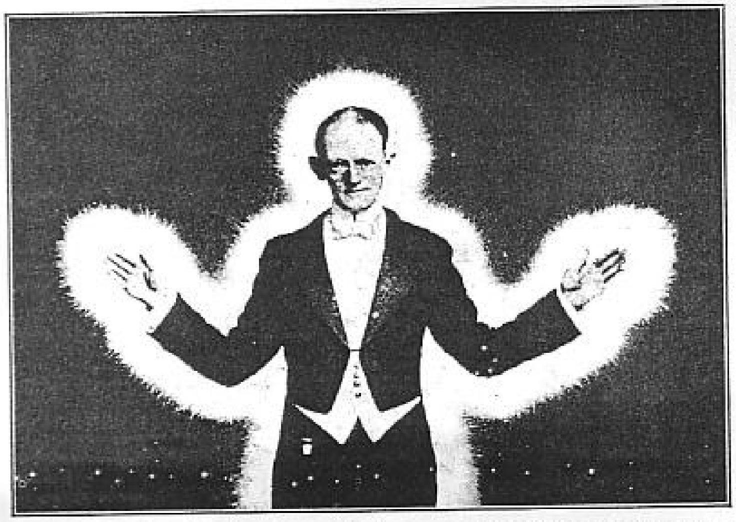
Electricity and Life

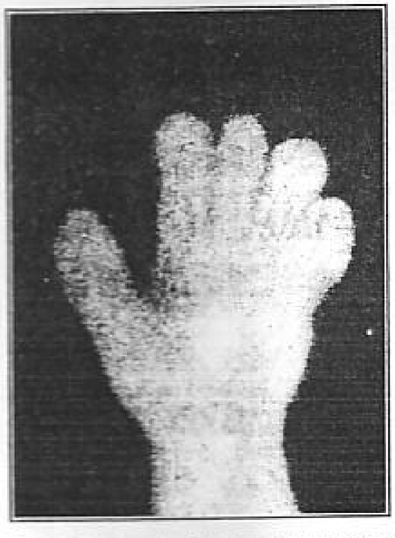
By FREDERICK FINCH STRONG, M.D.
Lecturer on Electro-therapeutics, Tufts Medical School, Boston

SCIENTIFIC progress during the past three decades has perhaps surpast that of all preceding ages; but we are still in the kindergarten class when we compare what is known with that which is still to be discovered. To *discover* means practically the same as to *uncover*, implying that the truth or fact was there all the time but was hidden, covered, occluded, or *occult;* and is it not a fact that many of the electrical discoveries of to-day would have been regarded as *supernatural* or *occult* by the scientists of a few generations ago? Of course there is nothing supernatural in the strict sense of the term, but many things remain *occult*, altho science is daily uncovering new and hitherto undreamed-of marvels.



Demonstrating in a Startling Manner, the Appearance of the Human (the Author's) Body When Charged With a High Frequency Current. This Picture Shows Exactly How a Person Charged From a Powerful High Frequency Apparatus Would Appear to Our Unaided Eyes, Were They Attuned to Respond to Vibrations of One or Two Millions Per Second, Instead of From 380 to 760 Million-Millions Per Second (the Range of Normal Human Vision). This Display Greatly Resembles the Natural Aura Surrounding the Human Body, but which Average Persons Can See Only by Gazing Thru Special Chemical Screens.

There exist great *Cosmic Forces* of which we still know but little. Gravitation is one of these; we know something of its laws and the results of its action, but nothing whatever of its real nature. Electricity is another; of this we know somewhat more, and we now recognize it in a variety of forms, as light, heat, chemical action, magnetism, etc., but its *true nature* is still a deep mystery. *Life-force* or *vital energy* is another great Cosmic Principle; thru its action electrons are formed into atoms, atoms into molecules, molecules into crystals and chemical compounds, and these into the bodies of plants, animals and of man. We have no name for this force, but thru its action the great Cosmic Scheme of Evolution goes on. In India they call it by a Sanscrit name—*Prana.* Here in the Occident we have not yet officially recognized this force; it is quite unorthodox to even suggest that it exists—simply because we have not been able to measure and record it by our still comparatively crude laboratory instruments.



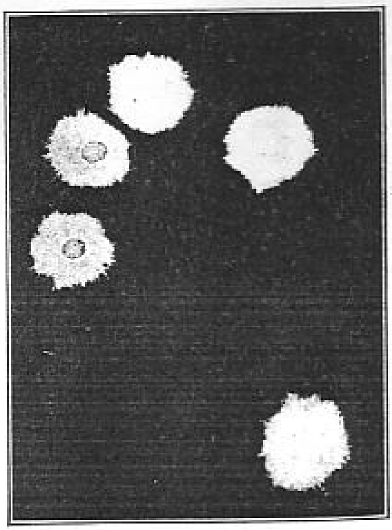
Electrical Autograph of the Human Hand, Showing the Radiations from it When Charged with a Powerful High Frequency Current.

A few years ago, when almost every scientist was a materialist, we believed in nothing but matter and force; to-day science recognizes the necessity of a third basic principle, *Intelligence* or *Mind;* without this we can satisfactorily account for none of the facts of the world in which we find ourselves. Its manifestations in matter thru the Cosmic Forces give us at least a working hypothesis of life.

As electricity has been the great field for the investigations of the past century so will the nature and manifestation of the *Life-force* be the source of the discoveries of the future. Even to-day we may hazard a few statements regarding this hypothetical *Prana* or *Vital-force.* For example, it comes to us—like all other active forces—from the Sun. It is stored and transmitted by plants and by the oxygen of the air, and in the human body it appears to be distributed thru the great Sympathetic Nervous System to every organ and tissue of the body. The Sympathetic nerves radiate from the Solar Plexus—our *Sun-center.* If bacteria or poisons interfere with this circulation, as for example in *infantile paralysis,* the muscles from which the supply of life force is cut off, lose their power of reaction and wither away. It is in this connection that we may study the action of certain electric currents as applied to the treatment of disease. It would seem that certain types of alternating currents of high frequency and voltage greatly facilitate the distribution of this vital principle (Nerve-force, Prana, or whatever you choose to call it), and this explains the action of one of the most valuable of recent medical discoveries.

In 1893, Dr. Nikola Tesla described in a magazine article the remarkable effects upon himself and his assistants resulting from their exposure to the action of alternating currents of exceedingly high-voltage and frequency during some research work. He prophesied that when electrical oscillations were fully understood and applied by physicians that a *universal healing agent* would have been obtained—one which would so increase the vital energy and resistive reaction of the human body as to enable it to throw off all disease. The present writer, acting on this hint, constructed a high-frequency apparatus, tested it on a number of patients and reported his results to a local medical society in 1895. So far as can be learned this was the first clinical work ever done with the Tesla Current, altho d'Arsonval in Paris was then experimenting with his relatively low voltage currents, produced from 3,000 cycle alternators. Later, Apostoli, Denoyes, and others reported remarkable results from the currents induced in the bodies of patients placed inside of huge solenoids or wire coils thru which high frequency currents were passing. The effects obtained were: increase of strength, appetite and weight, induction of natural restful sleep, and increase in tissue combustion and elimination.

Early in 1895 the author devised the first *Vacuum electrodes* for applying Tesla currents to the patient. To-day thousands of physicians are using this device, often *miscalling* it the Violet-ray Treatment. This is of course a misnomer, the violet light in the tube having nothing whatever to do with the healing effect produced by the transmitted electrical oscillations.



A Striking Electrical Autograph of the Tips of the Four Fingers and Thumb of the Author's Left Hand. A High Frequency Current Charged the Hand while It Rested on a Photograph Plate, With the Results Shown.

(*Continued on page 831*)

ELECTRICITY AND LIFE.

(Continued from page 798)

Some years ago the great Swedish scientist, Arrhenius, was reported to have subjected one-half of a class of school children to the action of high-frequency currents, one hour daily for several months, at the end of which time there was marked increase in the average growth, weight, general health and mental ability in the electrified pupils as compared with those not so treated. At the present time high-frequency currents are actually being used in truck-gardens to promote the growth and increase the size of vegetables for table use.

The high-frequency currents, in short, act as *vitality boosters*—no other form of electricity will do this. *Galvanism, Faradism, Static* electricity are all valuable agents in the hands of the Electro-therapeutic specialist, but they have little direct action in promoting cell vitality and growth, as do the high-frequency currents when properly applied.

Authorities explain the action of high-frequency currents in various ways, the favorite theory being that the healing effect is due solely to the liberation of heat in the tissues. It is perfectly true that in many diseases the heat liberated in the body by the passage of from 400 to 2,500 milliamperes at a frequency of about one million cycles is an important agent in promoting an artificial inflammatory reaction and increasing circulation. The heat is, however, only one of the *secondary* forces generated by the current; there are many other factors in the vitalizing effect. The thermic theory will, for example, not explain the increased growth of plants produced by the action of high-frequency currents of very high voltage and low amperage. In medical practise often the most marked results are obtained by the use of Tesla currents of low intensity, but of exceedingly high potentiality. The author can account for these effects only on the theory that these currents, when of proper frequency, are *synchronous with the normal rate of sympathetic nerve vibration*, and in this way increase the flow of the mysterious *Pranic* force thru which function and tissue growth are maintained.

High-frequency currents are now extensively used by the medical profession to increase cell growth, metabolism and functional activity. They tend to normalize the blood pressure and are the only agents that are of real curative value in certain stages of Arterio-sclerosis (hardening of the arteries). They greatly augment the defensive powers of the organism, enabling it to resist and overcome disease-producing agencies. The prejudice against high-frequency currents on the part of many physicians may be attributed to the fact that they do not employ proper technique or that they use an apparatus which does not admit of proper variation of frequency, amperage and voltage, in order to suit the requirements of the individual case.

In the next article the author will describe the details of construction of an apparatus suitable for the generation of high-frequency currents for therapeutic use and the technique for their application.

AN ELECTRIC "MOVIE" MACHINE FOR THE HOME.

(Continued from page 795)

The mother may catch on the film the first steps of the toddling baby; the boy can snap his mates at play; the family can have their birthday motion pictures of every member, not to mention the Thanksgiving and Christmas reunions.

The adoption of this instrument to the study of various subjects will be of immeasurable value, especially in geography, biology, chemistry and physics, which will certainly be simplified by the use of this invention. The new device may be used with equal advantage for projecting visualized bulletins for public use. It is without doubt one of the greatest inventions in the motion picture field and will certainly solve many dubious problems.

20,000 LEAGUES UNDER THE SEA.

(Continued from page 791)

fore, it is also fitted with a torpedo, which is later actually discharged at one of Capt. Nemo's enemies.

Our second photograph illustrates the submarine's sea drop-door open, one of the sailors emerging under the water. The crew, when starting on its undersea journey, is equipt with the necessary diving apparatus, these being self-contained and employing no lines or pipes with which to supply fresh air. On the back of the sailors are strapt compress air tanks and these are carried about without undue trouble. The divers' feet are covered with shoes having heavy leaden soles so as to increase the body weight, permitting the operator to walk on the bottom of the sea.

We see several wonderful actual scenes at the bottom of the ocean and one of our illustrations shows a photograph of the crew of the *Nautilus* walking on the sea bottom entirely free from any encumbering connections whatsoever. One of the sailors can be seen holding a sea turtle which he is carrying in his hand, clearly shown in our illustration.

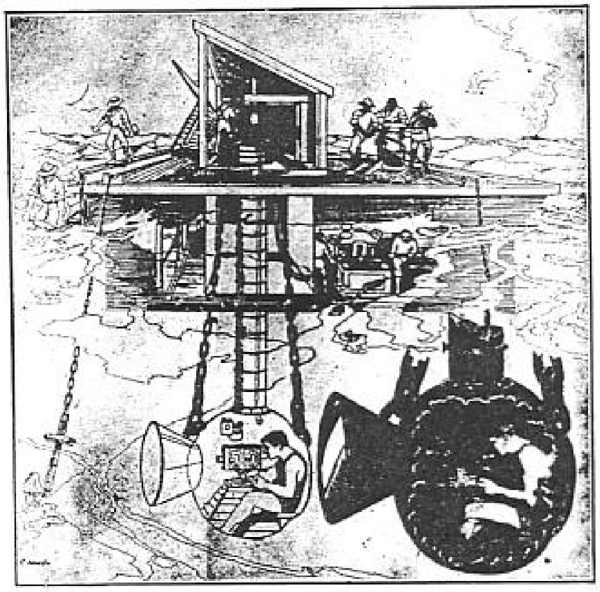
Considerable difficulties are encountered in walking on the ocean bottom, due first to the tremendous water pressure and second to swift currents along various points. Many interesting underwater performances are given by Capt. Nemo and his crew; the scenes showing actual man-eating sharks and hunting them, is perhaps one of the most thrilling pictures ever made. There is no faking in these pictures and in one of them can be actually seen how one of the sharks makes a vicious slash at Capt. Nemo, only to be rebuffed with the butt of his rifle. Another fascinating scene is that showing a battle with an octopus with Capt. Nemo, but this scene was obviously staged with a dummy octopus. Another scientific feature shown, which, by the way, was predicted by Jules Verne, is the employment of compress air guns which are quite necessary for the undersea hunts.

What the audience of course does not see is how these pictures were taken. It involved the use of wonderful electrical equipment in producing this most remarkable film. To begin with, a special camera had to be employed. This was enclosed in wide tubes fitted with powerful lenses at the lower end. Into this tube was placed a regular photographic motion picture camera as well as the person operating it. While many of the pictures were taken in actual sunlight (the sun shining directly thru the water and giving sufficient illumination, providing the depth was not too great), most pictures were taken at such a depth that electrical illumination was necessary. This was accomplisht by projecting powerful beams from electrical searchlights on the scenes to be filmed. The electrical energy supplying these monstrous electric arcs was fed thru heavy submarine cables and attached to dynamos driven by gasoline engines, supported on barges near the scene of this Twentieth Century Capt. Nemo's exploits.

As an educational film, "20,000 Leagues Under the Sea" probably rivals anything that has appeared heretofore.

It is a great pity that Jules Verne, who died some eight years ago, could not have lived to see this wonderful picture, which so well demonstrated his vast knowledge in all the various branches of science.

Photos Courtesy of Universal Film Company



Illustrating the Novel Manner in which Scenes for the "20,000 Leagues Under the Sea" Movie Spectacle Were Photographed by Placing the Camera and Operator (In Swimming Suit) Down in a Special Tube.

FUR COAT "ELECTRICITY" BLOWS UP AUTO.

Electricity induced by the friction of a fur coat worn by Surgeon Raymond Spear, U.S.N., grounded thru an automobile standing on wet ground and caused a spark which exploded the gasoline, burning Surgeon Spear severely and destroying the machine. The surgeon was able to leave the naval hospital here, but still is under treatment at his home.

Surgeon Spear had walked some distance to his garage in his fur coat and rubber boots. The friction of the flapping of the coat against his legs generated the electricity, while his boots insulated him from the ground and allowed his body to store it. A spark did the rest.

CELEBRATING MR. EDISON'S BIRTHDAY.

The employes and associates of Mr. Thomas A. Edison celebrated his seventieth birthday at a dinner held in the electric storage battery building, West Orange, N.J., at 6:30 p. m., Saturday, February 10. The event was informal and entirely social, and about 1,500 persons were present. Some of Mr. Edison's personal friends and former associates were invited. Mr. Edison's birthday is really on February 11, but on account of that day falling on Sunday, it was decided to hold the celebration on Saturday the tenth.

Electricity and Life

The Construction of High-Frequency Apparatus for Medical and Lecture Use.

By FREDERICK FINCH STRONG, M. D.
Lecturer on Electro-therapeutics, Tufts Medical School, Boston

(Second Article)

IN the March number of THE ELECTRICAL EXPERIMENTER the author pointed out that high-frequency currents, when properly tuned, acted as "Vital Boosters," increasing all the functions of the body and helping it to resist and throw off disease. This vitalizing effect is not due to the mere liberation of heat in the tissues, for it is produced by the very high-voltage ("Tesla") currents as well as by the heavy amperage ("D'Arsonval") currents from which the thermic effects are usually obtained.

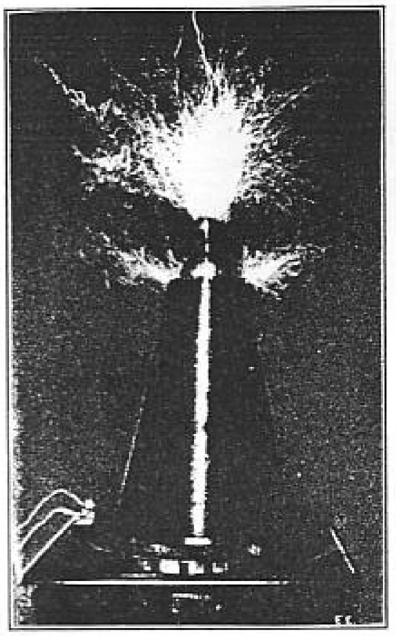


Fig. 1. View of the Strong Conical Oudin High Frequency Coil Delivering a Veritable Tree of Sparks Several Feet in Length.

When the writer demonstrated the first therapeutic Tesla Coil and the first Vacuum Electrode—(in 1896 before a Boston Medical Society)—and suggested that this method was destined to come into general use as a vitalizing agent, he was laughed at by his colleagues; yet to-day there is scarcely a well equipt physician's office in this country or in Europe that does not contain some form of therapeutic high-frequency apparatus. Even the barber-shops of the present time have their small "Violet Ray" outfits; and these are not by any means "fakes" for they produce real results, such as the relief of headache, neuralgia, skin diseases, et cetera.

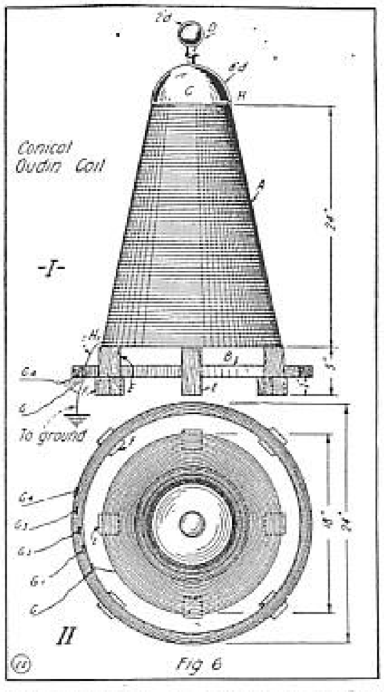
Unlike other forms of electricity, these currents may be administered to patients with perfect safety. In twenty years' experience in electro-therapeutics the author has never known of harmful results from the use of Tesla Currents applied thru a vacuum electrode. The heavy amperage ("D'Arsonval") currents, owing to their deep thermic effects, should be used only under the direction of a physician. The writer is a firm believer in the use of Tesla currents in the home—if each member of the family could receive ten-minute daily treatments from a small high-frequency apparatus, the general standard of health would be greatly increased. This has been demonstrated in hundreds of cases.

The author has interviewed a number of the more prominent authorities on medical electricity and they agree as to the vitalizing effects resulting from daily high frequency treatment.

Anyone who possesses a ¼ or ½ K.W. wireless transformer, operating on 110 volt, 60 cycle A.C., can easily construct an efficient high-frequency outfit for medical or lecture use. The complete equipment includes a .01 microfarad glass plate condenser, Tesla coil, inductance, spark gap and electrodes.

The Tesla coil is made as follows: (Fig. 3) On a paper mailing tube 2½" diam. and 14" long wind 480 turns of No. 34 D.C.C. copper magnet wire. Set up the tube in the lathe, apply a coat of orange shellac, spin on the wire, apply a second coat of shellac and allow to dry thoroly. The winding occupies twelve inches, leaving a margin of one inch on each end of the tube. Leads of light auto (ignition) cable are soldered to the ends of the winding. A strip of waxed, corrugated paper M, 5" wide is wrapt around the center of the secondary tube and on this is wound the primary, consisting of four turns of heavy high tension auto cable, and thoroly secured by tape; at least a foot of cable should project from each end of the winding to form the primary leads. Place the coil in a wax tight box made without nails and embed it in a mixture of four parts rosin and one part beeswax. It is safer to boil the coil for an hour in the insulating mixture before placing it in the box. Coils made in this way by the writer are still giving good service after fifteen years of use.

The greatest source of trouble in a medical high-frequency outfit is the spark gap; the one described below is the outcome of many years experiment. If properly made it will run daily for months without deterioration. The spark takes place between two pieces of brass rod 1¼" diam. and 3¾" long, turned and tapt as shown. The sparking surfaces are turned in annular grooves with a 60 degree tool. If your lathe has an automatic cross-feed you may set it to twenty turns to the inch, and turn a spiral groove instead of the annular rings. After finishing, the brass pieces are *heavily silver plated* and mounted in the usual manner as shown. (Fig. 4.) For currents over ½ K.W., a plate of silver should be soldered to the brass before turning the grooves. This gap will also give greater efficiency in wireless work as compared with the usual stationary gap.



Details Are Given In This Article for Constructing a Reliable and Powerful Oudin or Tesla High Frequency Coil, Suitable for Physicians' Use. This Type of Coil Is the Most Efficient Ever Designed.

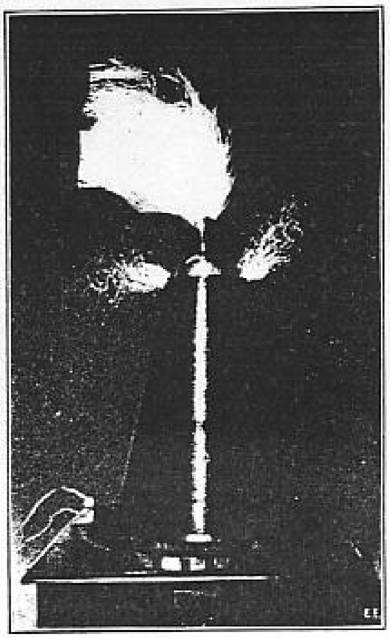


Fig. 2. Another View of the Strong High Frequency Coil Producing a Perfect Sheet of Flaming Sparks to a Grounded Conductor. The Exciting Energy Is but 1 Kilowatt.

The connections for the various parts of the apparatus are shown in Fig. 5. An important feature is the use of an external inductance or tuning coil "d" in series with the Tesla coil. It consists of 32 turns of No. 8 bare copper wire, wound on a frame 8" diam., with ¼" between turns. Edgewise wound flat copper strip is better but more expensive. (d Fig. 8.) This coil when used in series with the Tesla primary enables us to tune the oscillating system in perfect resonance when the capacity of the patient's body is added to the Tesla terminal. Effects are produced which are impossible with any other method. The beautiful *High-frequency Effluve* or brush-discharge, so valuable in treating pulmonary diseases, and which so few modern high-frequency machines can produce, is obtainable by the use of this series inductance. It may also be used, by short-circuiting the Tesla primary, as an auto-transformer from which may be derived heavy "D'Arsonval" and "Diathermic" currents as described in the next article of this series.

For stage demonstration and public lecture work the writer employs a large high-frequency resonator which produces a tree-

(*Continued on page 59*)

purpose after exhaustive experimentation. The paper is pierced with a pin-hole at the center when assembling the arc gap, and also it is extremely important as to just what kind of paper is employed—one of the best papers for the purpose having been found to be a certain kind of water line bond. The editor of this column does not recollect just now as to who made this paper, but you can obtain the name of the concern supplying this particular writing paper by communicating with the Institute of Radio Engineers, New York City.

An arc may be started with 500 volts using a small gap of 1/100 inch or so, especially where the circuit is made and broken by a quick break switch. The transformer described by Mr. Farmer would be rated at about one-half kilowatt.

FORMULA AND RECIPE BOOK.

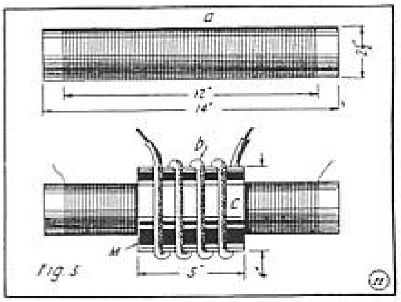
(784.) Tom Otis, Cedar Rapids, Iowa, writes for information on a book containing formulas and recipes:

A. 1. You will find books containing several hundred different formulas listed in our Book Catalog, which we shall be pleased to forward you on request. We shall also continue to publish a number of these formulas monthly in THE ELECTRICAL EXPERIMENTER.

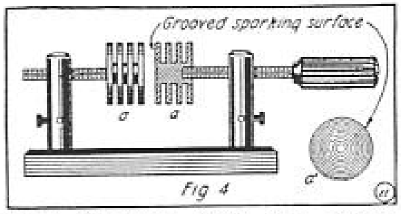
ELECTRICITY AND LIFE.

(Continued from page 24)

like discharge three feet in diameter (Fig. 1), and gives a heavy arc over two feet in length. (Fig. 2.) This shows remarkable efficiency when it is considered that the resonator is excited by a "Type E" transformer drawing only 1 K.W. and a condenser of but .01 m.f. capacity. A small rotary spark gap is used such as is supplied by the E. I. Co. This result is made possible by the use of the separate inductance in series with the resonator primary (exactly the same as that described in connection with the therapeutic apparatus) (d Fig. 8). The writer believes his resonator gives the most spectacular discharge ever obtained from 1 kilowatt of energy.



How Small Size Tesla Coil for Medical Treatment Is Built; "b" Is the Primary, "a" the Secondary.



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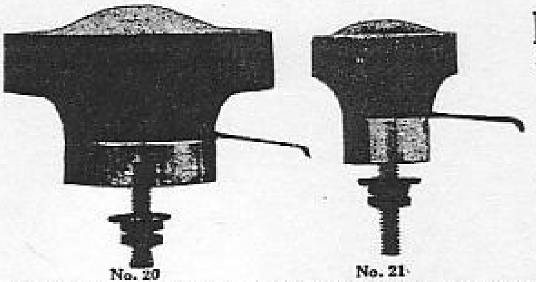

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No. 20 Switch complete - -	per 100	$52.00
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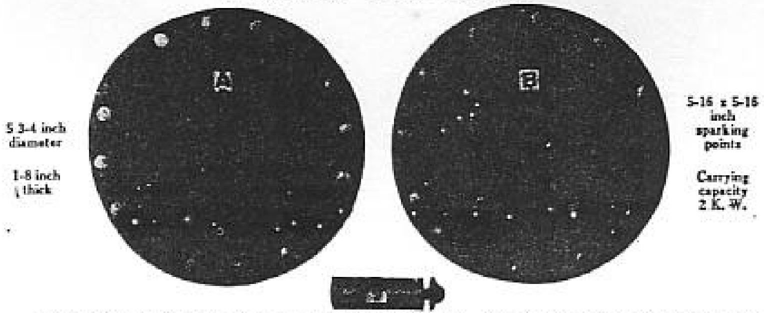
" 14 Brass contacts 5-16 in. x 5-16 tapped 6-32 -	"	2.50

ROTARY GAP DISCS



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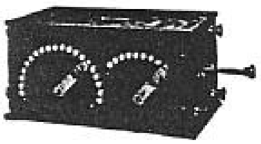

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15,000 Meter Loading Inductance in quartered oak case with 9 taps, only $8.00. Send 2-cent stamp for bulletins.

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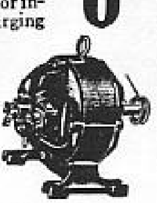

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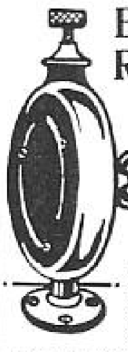

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The gap is enclosed in a circular iron housing 8 inches in diameter and 2½ inches thick, with removable cover (for inspection). The adjustment can be as close as desired between sparking points.

Rotating disc is of brass with 12 projecting round brass arms (total diameter 6 inches), mounted on shaft running in bronze bearing and is belt driven by small motor giving a variety of tones depending upon the speed,

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Price complete, without motor, $8.50

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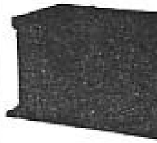

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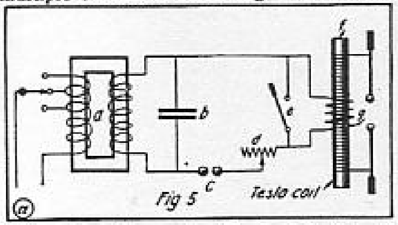
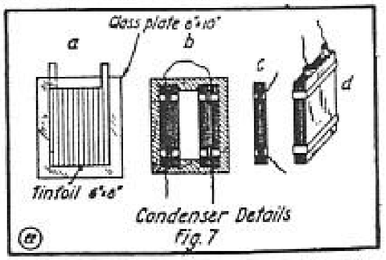
unit and boiled in wax give a capacity of .01 m.f. For safety it is better to employ four of these sections connected in pairs of .02 m.f. each (b Fig. 7). To run this resonator at full power for long periods of time it would be safer to use a series multiple condenser consisting of three sections of .03 m.f. each in series. Such a condenser would contain 108—8 x 10 inch plates, and would be expensive, bulky and very heavy. For this reason the writer has found it much more convenient to use a single 12 plat. (.01 m.f.) condenser across the transformer secondary and to replace it when it punctures. The large resonator was operated for six months in lecture and experimental work before a condenser section broke down.



Connection Scheme for Tesla Coil "f—g," Shorting Switch "e," Tuning Inductance "d," Spark Gap "c," Condenser "b" and Step-up Exciting Transformer "a."

The cone for the secondary of the large resonator is of hea paperboard and was built for the author by Bicknell and Fuller of Boston. Its dimensions (see Fig. 6) were suggested by Mr. Earle L. Ovington, the cone being similar in shape to those used by Mr. Ovington in the New York Electrical show several years ago. Any amateur can make a cone of this kind by superimposing strips of heavy paper, soaked in paste, over a wooden framework. The secondary winding consists of 400 turns of No. 27 D.C.C. copper magnet wire. Two parallel strands of wire are wound onto the cone, the adjacent turns in contact; after winding, one strand of wire is removed, leaving a space equal to the diameter of the wire between each of the 400 turns. The cone and winding is then treated with several coats of "*Armalac*" (ordinary shellac will not answer).

The primary consists of five turns of thin copper ribbon 1 inch wide, ⅛ inch paperboard strips being placed between the turns. The diameter of the coil is 24". When completed it is taped and rotated in a pan of melted wax until thoroly impregnated. The terminal shown in the photographs is made from a large brass oil-can, the stem being removed and replaced by a 3" brass "bed-ball." The terminal is not attached to the cone but simply rests on its upper surface in contact with the end of the secondary wire. The primary and secondary are separately supported by quare wooden blocks; the coupling is rather loose, the bottom of the resonator being at least two inches above the primary. The lower end of the secondary coil is attached to the inner primary terminal and grounded.



Details for Building High Tension Glass Plate Condenser to Be Connected in Tesla Coil Circuit.

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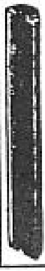

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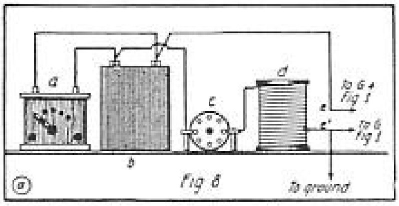
Perfect resonance is obtained by varying the number of turns in the inductance coil in series with the primary. (Fig. 8.) This tuning system enables us to perform many brilliant experiments *otherwise impossible*, such as illuminating wires stretched across a lecture hall, lighting an inverted umbrella, etc. Some new and very spectacular experiments with this large resonator will be described and illustrated in an article in next month's "ELECTRICAL EXPERIMENTER," entitled "Methods of employing high-frequency currents in medical and lecture work."

The author is greatly indebted to Mr. O. K. Luscolm, for advice and assistance which made possible the successful construction of the large resonator.



Method of Connecting Transformer, H. T. Condenser, Rotary Spark Gap and Tuning Inductance "d" to Large Oudin Coil.

At a recent lecture before the Belfast Association of Engineers Mr. A. W. Brown suggested the transmission of power generated from the tidal rise and fall of the water at Strangford Lough and Lough Neagh to Belfast. Thus, at Strangford Lough there are twenty square miles of water available, the spring tides have a rise of 14½ feet and the neap tides a rise of 11¼ feet, with a range of 7½ feet. About 20,000 horsepower could be developed for a period of two and one-half

THE WASHINGTON'S BIRTHDAY RELAY PRIZE WINNERS.

(Continued from page 23)

live in a state that has as much real earth in it as is blown into the air in some of our larger states during every wind storm!

These few think they are very important and if you don't do as they say, why the Government will close you up. They say "The Danger Signal is up." Did you ever hear of a good, red-blooded American Kid who could be bluffed? No! It is not in your make-up. The Government is only too anxious for you to perfect yourself in the art, and help it out by joining the "Radio Reserves."

PRIZES.

This is a stunner for one who would like to give everybody that helped a prize, but it can't be done, so I am going to ask the boys who acted as sending stations to consider that they are one of the family and help me by agreeing that the prizes should go to the boys who made the best records in receiving and delivery. The rest of the amateurs will be rewarded by having their names printed in this magazine, so that when you grow older and have a little one on each knee in front of the old log fire, some cold night, you may read to them about Daddy and what he did when he was a mere boy.

Before you all get busy reading about the prize winners, I want to call your attention to several hard workers who turned in the most complete reports, or "logs," of the relay, that the writer has ever had the privilege of reading.

Hoyt, of Hayward, California, 6 SI, who is also a prize winner, turned in the most complete report ever seen.

Stewart of St. Davids, Pennsylvania, 3 ZS, whom you all know as one of the hard hours, the power available varying from maximum to minimum every six hours.

workers of the Radio Association of Pennsylvania, turned in a truly wonderful report, but he stayed up till nearly 6 a.m. the next morning, boys, and from the looks of his "log," he went to sleep with the pen in his hand. It really only took me about *two hours* to digest this report.

Emerson of Dallas, Texas, 5 DU, as ex-man-o-warsman, turned in a regular Navy Report, brim full of interest and curt reports. He, too, along about the dog watch, evidently slept on duty. Bet

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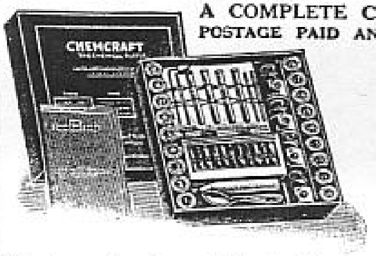

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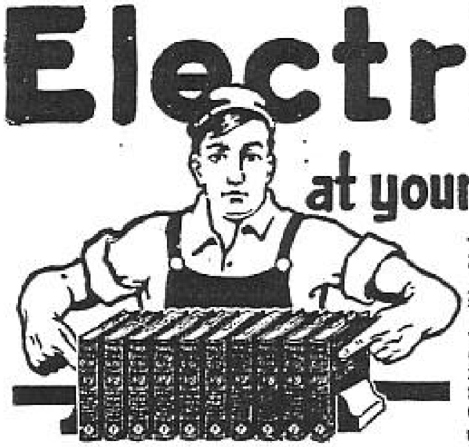

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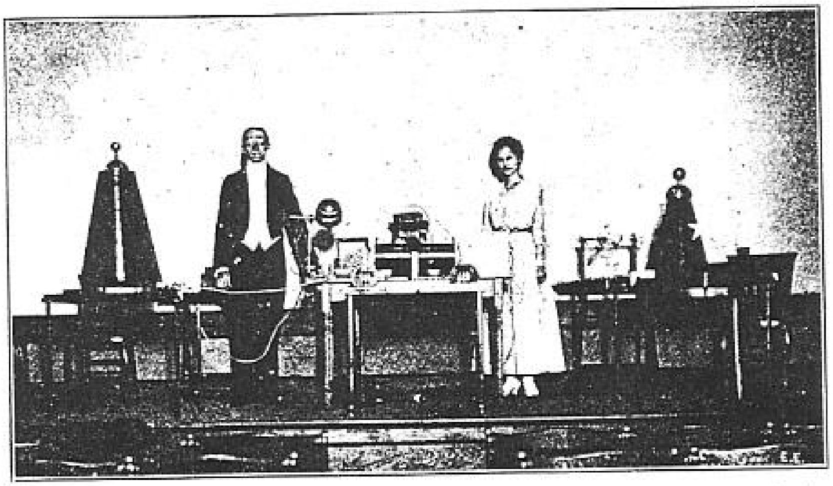
How to Use High Frequency Currents in the Treatment of Disease

By Dr. FREDERICK FINCH STRONG.

Lecturer in Electrotherapeutics, Tufts Medical School, Boston



This Photo Shows Dr. and Mrs. Strong with the Elaborate Apparatus Used in Lecturing in Different Cities. Note the Large Conical Oudin Coils in Full Activity.

NOW that the exigencies of war have temporarily suspended the activities of amateur Radiotelegraphers, many of those possessing transmitting outfits are using them for the experimental study of the phenomena of High Frequency currents.

In the ELECTRICAL EXPERIMENTER for May, 1917, the writer described the construction of a Tesla D'Arsonval high-frequency outfit made from standard "Wireless" apparatus, consisting of a ¼ or ½ K.W. transformer with glass plate condenser and oscillation transformer, the latter used as a series inductance to obtain various effects from the Tesla coil, or as a "D'Arsonval Solenoid" for obtaining the "Diathermic" and "Auto-condensation" currents so valuable in the treatment of certain diseases.

Many excellent results can be obtained from high-frequency treatment administered by those who have little or no knowledge of medicine. A physician's advice should always be obtained before undertaking the treatment of any serious case, but the amateur may safely employ moderate doses of Tesla currents, and even mild diathermy and autocondensation, provided he makes himself reasonably familiar with the elementary principles of electrotherapeutics.*

In a few States there is a law prohibiting the therapeutic use of electricity by any but licensed physicians, but even this would not apply to treatments given gratuitously by amateurs to relatives or friends. A number of the writer's former pupils have become successful practising electrotherapeutists, altho they are not physicians. Most of them wisely refrain from the use of the sinusoidal, Galvanic and static currents; these belonging more to the field of the electro-medical specialist.

A simpler and cheaper apparatus than the one described in the May issue of this journal will give all the varieties of therapeutic high-frequency currents that may safely be used by the amateur. It is made up as follows:—

Transformer,—Any standard ¼ K.W. radio transformer (E. I. Co., Clapp-Eastham, Thordarson, etc.)

Condenser,—Standard wireless glass plate condenser, one section of .005 microfarad; two sections of .01 m.f.; each in series will be safer.

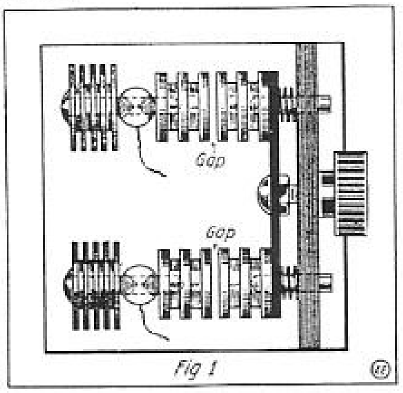


Fig. 1. A Simple Form of Fixt Spark Gap, Found Very Satisfactory for High Frequency Outfits.

Inductance Coil, ("D'Arsonval" solenoid), thirty turns No. 12 bare copper wire, wound around a wooden cage 8" in diameter., ¼" between turns.

Spark gap,—Adjustable series gap, made as shown in the diagram, Fig. 1. The sparking surfaces are of copper, turned in annular or concentric grooves as described in a previous article. Copper washers of ½" and 1" diameter, are slipt alternately on an 8-32 machine screw, and form the heat radiating wings. The further construction and operation of the gap is indicated in the drawing.

Tesla Coil,—Identical in winding to that previously described, viz.,—secondary—on a 2" diameter paper mailing tube wind 480 turns of No. 34 S. C. C. magnet wire (40 turns to the inch; 12" winding, 1" margin on each end). Slip the secondary into a 4" mailing tube, center accurately by means of three corks in each end, seal one end by standing coil on end in a shallow pan filled with melted resin, and when cold fill the annular space between tubes with a mixture of beeswax (yellow) one part, to resin, 5 parts. Wind primary, consisting of six turns "Magneto" cable (which can be bought for five cents a foot) around center of outer tube; turns spaced ½" apart. Secondary leads, of magneto cable, should be connected to the outer posts of the writer's "triple terminals." One arrangement of the complete apparatus is shown in Fig. 2. The triple terminals greatly facilitate the therapeutic use of the Tesla Currents, and also afford an opportunity for studying different forms of the high-frequency discharge. The actual terminals, A and C, are formed of two moulded high-tension insulators, surmounted by 2" brass bed balls, (known to the furniture trade as "brass vases"); thru terminal A slides a brass rod having a rubber or hard-wood handle on the outer end, and a 3" flat brass disc on the inner end. Terminal C is similar but has a small brass ball on the inner end of the sliding rod. A "Dummy" terminal, B, is mounted as shown, midway between the actual terminals. By closing the gap between the brass discs and opening that between the balls B and C, an arc discharge is obtained, while by closing gap B C, and separating the disc electrodes, the discharge forms a beautiful purple brush or "effluve."

In giving treatments the patient is seated on a folding *condenser pad* of thin fibre of Bakelite, Fig. 4, backed with copper or tin foil to which is attached an insulated cord connected with terminal C. The operator will require a set of vacuum electrodes, Fig. 5, a metal hand electrode formed of an eight-inch length of 1¼" nickeled brass pipe, "effluve" electrode made from the gong of an old electric bell screwed on the end of a hard-wood handle, and two pieces of sheet block tin 3" x 3" x 1/32" with insulated conducting cords soldered to their corners, Fig. 6. The condenser-pad can be obtained from any electro-therapeutical supply house, as also the vacuum electrodes and other materials.

For ordinary general treatment to promote nutrition, increase circulation and elimination—a treatment of value in almost any condition of impaired health—the balls and discs are widely separated and

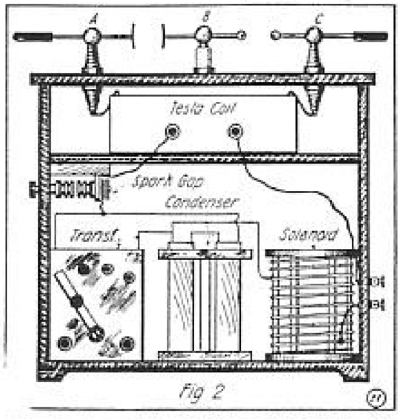


Fig. 2. Assembly of Apparatus in the Author's High Frequency Therapeutic Outfit.

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* The new edition of the writer's book, "Essentials of Modern Electrotherapeutics," now in press, gives all needed information, with an alphabetical list of various diseases and the method of treating them electrically.

the patient is seated on the condenser pad connected to the terminal C. Open the spark gap until a vacuum electrode lights up when held about a foot from the patient: this shows that the body is being charged inductively to a high potential, the charges alternating some 1,500,000 times per second. The patient feels nothing and is absolutely insulated from all electrical connection with the apparatus, yet hot sparks can be drawn from any part of the body showing that the whole organism is being subjected to a rapidly alternating molecular massage, which has the effect of increasing all the vital functions without acting as a stimulant. In other words the treatment tends to bring the patient into a normal condition, but it has no more effect upon a perfectly healthy person than pouring water into a pail already full. This is the reason why high frequency treatments may be safely given by those who are not physicians, whereas all other forms of therapeutic currents act as stimulants or counter-irritants and must be employed with precise knowledge and discrimination.

The condenser treatment as described above, is usually given for about fifteen minutes after which the bulb-shaped vacuum electrode is applied for a few minutes over the spine and solar-plexus. It is applied either directly to the surface of the body or thru one thickness of clothing. The insulating handle of the vacuum electrode is connected to the middle post B, in Fig. 2, and after turning on the current and placing the electrode on the patient, the discs A and B, are closed, being opened again before lifting the electrode from the surface of the body: if this is not done painful sparks will pass from the glass electrode to the patient. In treating obstinate cases of recurrent neuralgia, chronic rheumatism and partial paralysis, this vacuum sparking treatment is often beneficial, but it is rather unpleasant for most cases. A milder form of this counter-irritant effect is obtained by using the vacuum electrode over two or three thicknesses of clothing; it must be moved rapidly from place to place, otherwise the skin might be blistered.

For sedative effects and to reduce local inflammation and congestion, the vacuum electrode should always be applied directly to the skin or mucous membrane; this applies to such conditions as acute rheumatism, neuritis, tonsilitis, etc., an acute "cold in the head" (coryza) can often be aborted in one treatment by the above technique, using the vacuum electrode over the nose and the thin slender vacuum electrode in the nasal cavity.

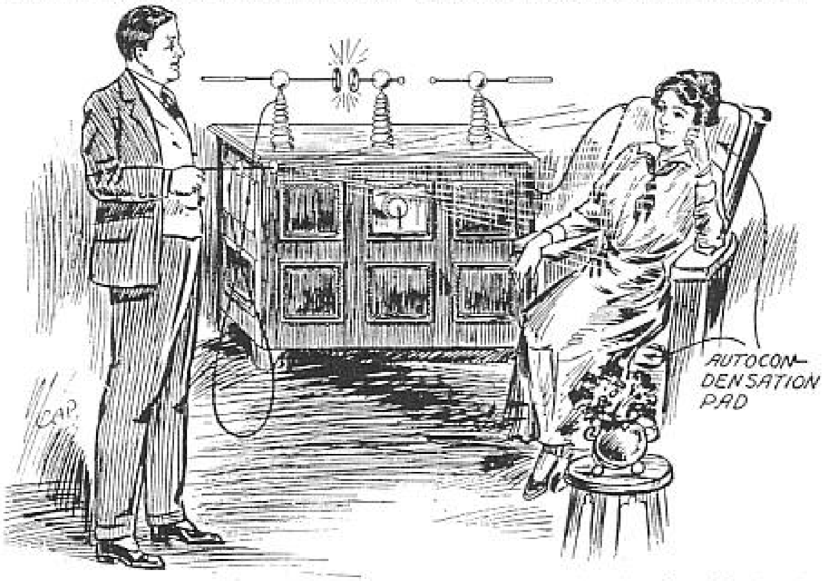
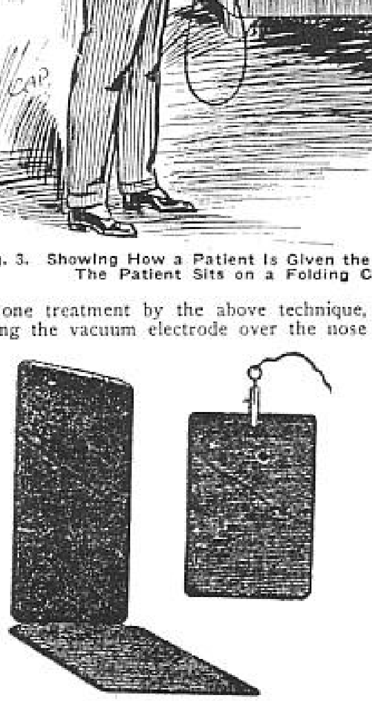


Fig. 3. Showing How a Patient Is Given the High Frequency "Effluve" or Spray Treatment. The Patient Sits on a Folding Condenser Pad Placed in the Chair.



Figs. 4 and 6. Condenser Pad Used for Giving Auto-Condensation Treatment and Auxiliary Tin Electrode.

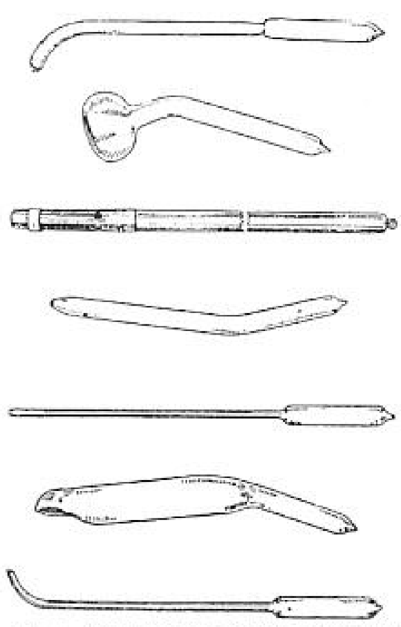


Fig. 5. Various Forms of High Frequency Treatment Electrodes. They Are Made of Glass.

In treating skin diseases, such as eczema and acne, where we wish to avail ourselves of the antiseptic and tonic effects of the "effluve," we connect the effluve electrode in place of the vacuum electrode, close the discs and gradually approach the bell of the electrode to the patient until a full, blue violet effluve plays upon the surface to be treated (see Fig. 3). To obtain the best effluve effects several turns of the tuning coil should be used in series with the Tesla primary (see article in May issue). The effluve is also valuable as a general tonic in sluggish conditions of the digestive system, also in nervous depression and functional nervous diseases.

For the relief of abnormal arterial tension—("high blood-pressure"), and in the treatment of *arteriosclerosis*, as well as in conditions involving excess of uric acid, we employ "D'Arsonval autocondensation." To obtain this current we short-circuit the Tesla primary by means of the single-throw switch, and attach the condenser pad to the lowest turn of the "Solenoid" or tuning coil. The patient clasps both hands around the metal "pipe" electrode connected to the upper turn of the coil, the current is turned on and the spark-gap opened until a pleasing sensation of warmth is felt flowing up the patient's arms. In all regular therapeutic high-frequency outfits, a hot-wire milliamperemeter is placed between the patient and the machine. This is not necessary in connection with the above described apparatus, as it only delivers a maximum of 800 milli-amperes to the patient—an amount well within the limits of safety. In chronic cases autocondensation should be given daily in twenty-minute treatments. This treatment should never be given immediately after eating, or in cases of "Bright's Disease," or in organic heart trouble. High frequency treatments are of great value, even in these conditions, but they should be applied only by a skilled specialist.

In inflammation following acute infection, as in acute bronchitis, incipient pneumonia, etc., we employ "local autocondensation" or "indirect Diathermy." In this method the patient sits upon the pad as for autocondensation, but instead of the metal handle we employ one of the plates of block tin; this is applied in close contact with the skin over the affected area, covered with a folded towel and held in place by the patient: a sensation of deep penetrating heat is felt, and relief from the pain and congestion follows. This is one of the most valuable methods in electrotherapeutics: were it available for the general practitioner, or better still, in the patient's home, there is no doubt but that nine-tenths of the cases of acute local infectious disease could be aborted. This is also of great value in the treatment of asthma.

Statistics show that one-seventh of all recorded deaths are due to Pulmonary Tuberculosis ("Consumption."): proper treatment in the home by high frequency currents would greatly increase the percentage of recoveries from this dread disease. Dr. Howard Van Rensselaer of the Albany Tuberculosis Hospital has reported 80% of cures by high frequency treatment, and an even higher percentage is reported by Dr. Alfred Geyser of New York. The writer feels that this subject is of sufficient importance to be treated in a separate article, which will appear in next month's ELECTRICAL EXPERIMENTER under the title "The Home Treatment of Tuberculosis with High-frequency Currents."

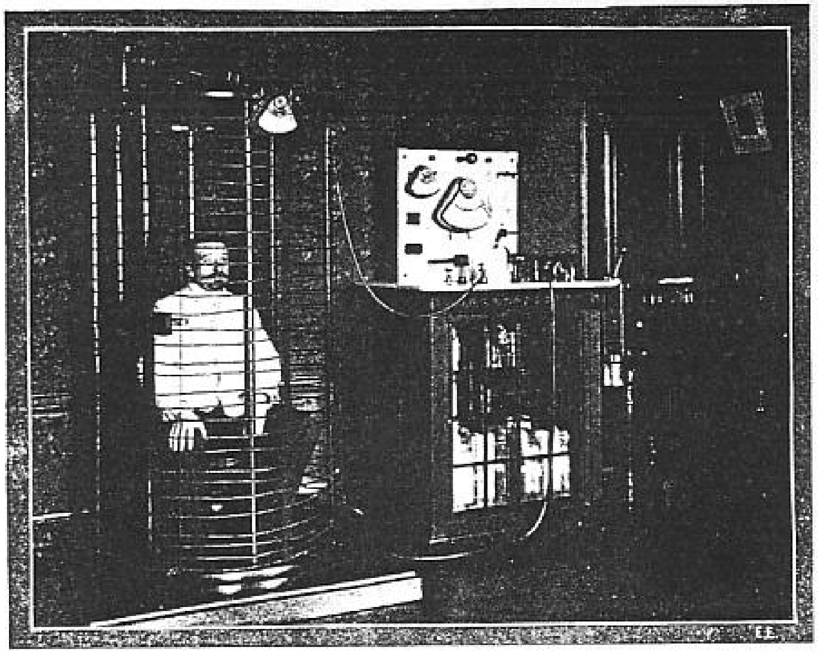
Electricity and Life

The Uses of High-Frequency Currents in Medical and Lecture Work

By FREDERICK FINCH STRONG, M. D.
Lecturer on Electro-therapeutics, Tufts Medical School, Boston

(Third Article)

THE phenomena of high-frequency currents offer us a fascinating field from which to select experiments for public lecture demonstration. In his lectures on "*The Realms Beyond the Senses*," the author has used high-frequency phenomena to demonstrate the existence of force and matter beyond the range of human perception. In "*The Science of the New Age*," he has employed similar means in calling attention to the fact that the investigators of to-day are leaving the crude matter of earth and are dealing more and more with *Etheric Force*—and with matter of a *super-gaseous* nature. The scientist of the future will have to provide himself with instruments far more delicate than anything hitherto dreamed of or else he will develop super-normal powers of perception by the manifestation of faculties already latent in the human organism.



Hardening of the Arteries—Most Dreaded of Ailments in Later Life—Is Successfully Treated By Placing the Patient Within a Wire Cage, Thru Which High-frequency Currents Surge at a Frequency of 600,000 Cycles Per Second: D'Arsonval's Method.

For the traveling lecturer who wishes to employ high-frequency currents in his work, the large resonator described in the last issue of THE ELECTRICAL EXPERIMENTER may prove somewhat cumbrous and difficult of transportation. Those who wish a lighter, more compact apparatus may use the small resonator shown in Fig. 1.

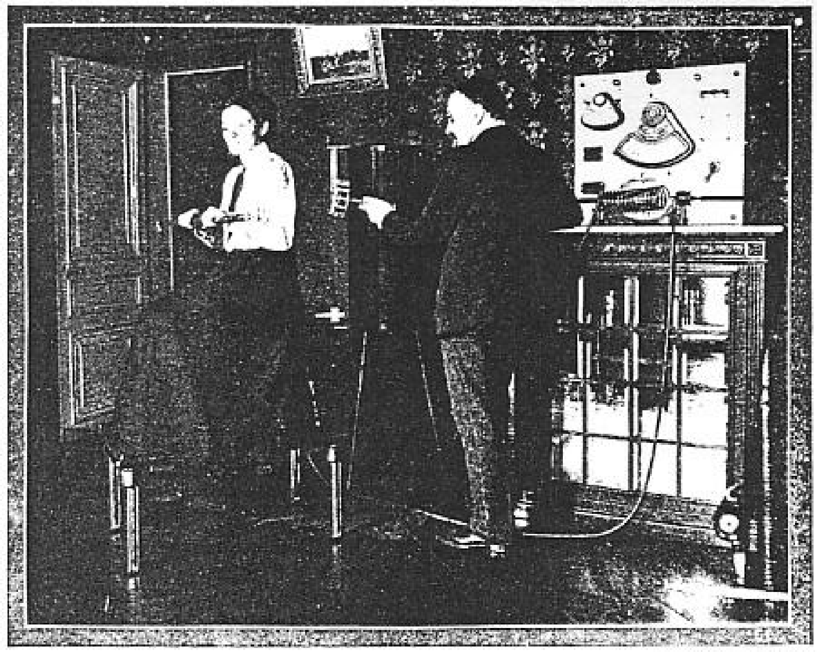
It is quite small, yet it sends out streamers two feet in length, and may be operated by a ½ K.W. "wireless" (step-up) transformer. With this little apparatus beautiful luminous effects may be obtained—as, for example, by connecting the terminals with a tin-foil star glued to a sheet of glass; with a suspended umbrella (opened); with a long wire running out over the lecture hall, etc.

For each of these experiments different tuning will be necessary—the series inductance coil being adjusted to balance the different capacities added to the resonator terminal.

This little resonator is made by winding 600 turns of No. 30 triple cotton covered wire upon a shellacked paper cone, 12 inches in diameter at the bottom, 5 inches at the top, and 14 inches high. It is a difficult matter to insulate this small coil as the turns of the winding are very close together; it can be done, however, by the use of from six to eight coats of *Armalac*. The primary coil is a ring, 18 inches in diameter, formed of five concentric turns of thin copper ribbon 1 inch wide. The exciting apparatus is the same as that described in the last paper in connection with the large resonator, except that a ½ K.W. transformer is used instead of the heavy 1 K.W. (See Fig. 2.)

The writer also employs a standard Clapp-Eastham ¼ K.W. Tesla coil excited by the same apparatus (see Fig. 3). Connected with two parallel upright wires the spark from this coil will run up and repeatedly reform again at the bottom, producing a very spectacular effect (Fig. 4).

Another brilliant experiment can be performed with two large glass flasks (ordinary carafes or water-bottles will do). One is filled with water containing a few drops of *fluorescein* solution—(a coal tar dye)—the other with water to which a small amount of *bi-sulfate of quinine* has been added; the bottles or flasks are placed about six inches apart and a wire from the Tesla coil terminal inserted into the solution in each. The current passes down thru the water and the arc takes place between the glass walls of the two flasks. The ultra-violet rays from the discharge cause the water in the flasks to become luminous—the quinine solution with a pale blue light, the fluorescein with a beautiful apple-green. The discharge apparently passes directly thru the glass walls of the flask; in reality, of course, the current passes by *induction* rather than *conduction*, the flasks acting as condensers in series. (See Fig. 5.)



Photos from Jacques Boyer

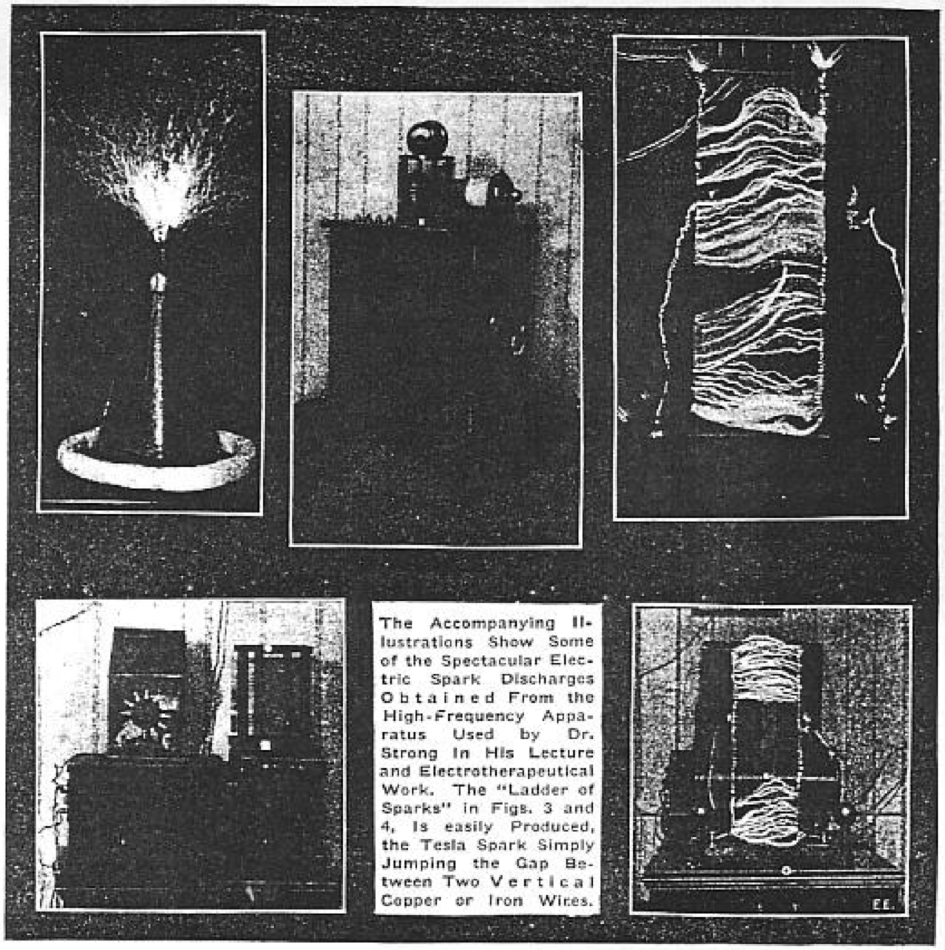
The "Effleuve" or High-frequency Brush (or Spray) Treatment Has Proven Highly Efficacious In the Treatment of Nervousness (Nerve and Brain Exhaustion)—"Neurasthenia." American Electro-therapeutists Find It Very Valuable.

The Use of High-Frequency Currents In the Treatment of Disease.

High-frequency currents are employed by physicians in four principal ways, each adapted to the treatment of certain types of diseased conditions. These are:

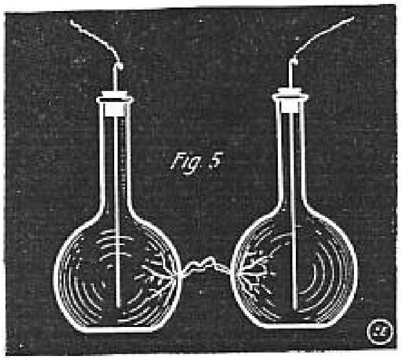
1. "Tesla" treatment with vacuum electrodes ("Violet-ray treatment").
2. "Effleuve" or high-frequency spray.
3. "D'Arsonval auto-condensation."
4. "Diathermic."

1. The method most frequently employed applies the Tesla current thru glass (vacuum) electrodes for the relief of local pain or inflammation. The little muscular pumps around the veins—the "vaso-motor system," which keep the blood circulating by withdrawing it from the capillaries and sending it back to the heart—act more vigorously in tissues over which the vacuum electrode is applied. In this manner waste products which cause rheumatism and gout are dissolved and washed away and fresh blood and white corpuscles are brought to infected parts, thus aiding nature in destroying disease-producing germs and their poisonous products.



The Accompanying Illustrations Show Some of the Spectacular Electric Spark Discharges Obtained From the High-Frequency Apparatus Used by Dr. Strong In His Lecture and Electrotherapeutical Work. The "Ladder of Sparks" in Figs. 3 and 4, Is easily Produced, the Tesla Spark Simply Jumping the Gap Between Two Vertical Copper or Iron Wires.

In most of the smaller high-frequency machines for physicians' use, but one Tesla terminal is provided; a coil of the resonator type being connected to the glass electrode by a flexible wire. The effects are largely local, but the method is of value in relieving pain, swelling and congestion. The writer has always advocated the bipolar method, even for treating purely local conditions. The best results will be obtained from the use of a Tesla outfit of the type described in last month's Electrical Experimenter. The patient is to be connected to one terminal of the Tesla coil by means of a metal electrode held in both hands (a piece of thin nickeled pipe will answer, 1 foot long and 1½ inches in diam.). In this way the current is diffused thru the entire body. The vacuum electrode, connected with the opposite Tesla terminal is applied to the skin over the affected part for from five to twenty minutes, a very short spark-gap being used. This method—employed by the writer for years—enables us to obtain the wonderful *vitalizing effect* of the high-frequency currents on the whole body simultaneously, with the local effects from the vacuum electrode.



Startling Experiment With Two Glass Water Bottles Connected to Tesla Coil. The Spark Jumps Between the Glass Surfaces and Illuminates Solutions Within the Bottles.

For the past few years the writer has been in the habit of connecting the Tesla coil with an *Auto-condensation pad* (as used in the "D'Arsonval" and "Diathermic" methods). This is formed of two plates of Bakelite, ⅜-inch thick, hinged to fit the seat and back of an ordinary chair. To the back of each plate is cemented a sheet of tin or copper foil, covered with leatherette. Suitable flexible conductors connect these metal plates with each other and with the Tesla terminal. This folding pad may be used in both "Tesla" and "D'Arsonval" treatment, and is quite as efficient for ordinary use as the cumbrous and expensive *condenser chair* or *couch*.

2. For the "Tesla Effleuve" treatment a brass *bell* electrode is used. This can be made from a common brass oil can, the flat bottom being removed and the resulting hollow hemisphere being mounted on an insulating handle; the discharge occurring from the sharp edge of the brass. The patient is seated on the Bakelite pad, which is connected to the Tesla coil. The opposite terminal is attached to the brass bell electrode and a sufficient number of turns of the inductance coil are placed in series with the Tesla primary to give a full, smooth "effleuve" or purple brush discharge, when the electrode is held from four to eight inches from the patient. By careful tuning a beautiful effect may be obtained. Close examination of this discharge will show it to be literally an electric "brush", formed of thousands of distinct, delicate, purple threads. Upon each of these hair-like paths of light countless millions of *ions* (electrically-active atoms), are being shot from the electrode to the patient at a speed of over 60,000 miles per second; the treated surface is therefore being submitted to a literal bombardment by countless microscopic projectiles which are thrown out in periodic showers from the electrode, once for each cycle of the oscillating current. Two effects are produced—one due to the penetration of the tissues by *ozone-forming ions:* the second to the rhythmic or *periodic impact* of the discharge upon the nerve endings in the skin and superficial tissues. The writer hopes ultimately to produce an apparatus of a frequency *exactly synchronous with the rate of vibration of the sensory nerves;* an "effleuve" from such a coil would produce a harmless and efficient local anæsthesia so that operations could be performed without the use of ether or cocain. The effects obtained from the "effleuve" as now used are stimulating and vitalizing to a marked degree. The nerve endings of the skin may be regarded as sensitive antennae of a complicated radio-system, and any intense sustained vibration to which the apparatus is attuned will be transmitted by them to the receiving station. The effect therefore, is not merely superficial but *systemic* as well. Tuber-

(*Continued on page* 152)

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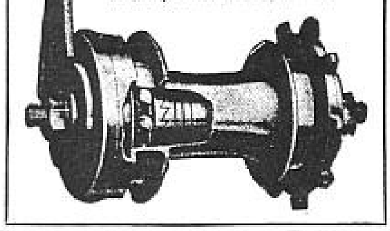

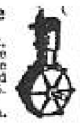

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JOE'S EXPERIMENT.

(*Continued from page* 150)

boy, before the circle of directors could close in on him.

"Shake," he cried, gripping his hand. "Any boy who can think of a thing like that deserves a chance to learn more, whether he can see or not. So if the company doesn't out of gratitude, I'll see to it myself that you go to the best technical school in the country."

ELECTRICITY AND LIFE.

(*Continued from page* 105)

culosis and other pulmonary troubles often yield to the "effleuve" treatment.

3. Perhaps the most remarkable therapeutic effect of heavy high-frequency currents is their power to liberate heat in the tissues of the body. For this purpose the so-called "D'Arsonval current" is used. This is a secondary current of high amperage derived from the heavy coil of copper strip shown in Fig. 6. The lower terminal of this coil is connected with the condenser pad on which the patient is seated; the tubular metal electrode is held in both hands and connected thru a Milliamperemeter with the upper turns of the coil. The clip is moved to different turns as in wireless tuning, until the meter shows the highest reading for a given amount of exciting current. The patient's circuit is in this way tuned in perfect resonance with the primary oscillations. After a few moments the patient's wrists become hot, the heat rapidly extending up the arms and into the body until profuse perspiration is produced. Ordinarily we do not carry the treatment as far as this; the safe dose for an average patient being not over 700 milliamperes for twenty minutes. This is "D'Arsonval Autocondensation", and is applied with great benefit to patients suffering with *Arteriosclerosis* ("hardening of the arteries"), and in a variety of other diseased conditions involving malnutrition.

4. In diseases in which we wish to induce a regenerative inflammation, promote circulation and absorption, and increase cell activity, the method known as "Diathermie" is employed. Instead of the hand electrode and condenser-pad the D'Arsonval current is applied thru two small sheets of block-tin about 2 x 4 inches. These are applied to the skin on either side of the affected part and a current employed which gives the patient a decided sensation of penetrating heat. Average treatments use from 1000 to 1600 milliamperes. In treating consumption (pulmonary tuberculosis) one electrode is placed on the back and the other on the chest over the affected lung. One Tuberculosis Hospital in which this treatment was given daily to a number of patients reported 85 *per cent of cures!* The author is working on an apparatus which will make possible the use of Diathermic treatment in the homes of patients suffering from this disease.

For office use and for the Electro-medical specialist ("Electrotherapeutist") the writer has recently designed an apparatus from which remarkable results are being obtained (see Fig. 6). The Tesla and D'Arsonval coils are excited by a wireless transmitting set of the well-known "Hytone" type. The *rotary quenched gap* with its exceedingly high-spark frequency produces an almost sustained wave in the High-frequency coils. Both for the Tesla and D'Arsonval treatment the writer believes this apparatus superior to any that he has used up to the present time. The vitalizing and exhilarating effects are extremely pronounced. The machine has the added advantage that there is no troublesome spark gap to adjust, the strength of the current being regulated by a many-stept rheostat in the primary transformer circuit.

Much has been done in adapting high-frequency currents to the treatment of disease, but much remains yet to be done before we shall be able to avail ourselves of the wonderful healing and vitalizing powers which these currents undoubtedly possess. The writer hopes to be able to continue his studies along this line, believing that when we can scientifically apply to our patients *pure undamped waves* of definite form, frequency, amperage and voltage, we will obtain results far surpassing anything that we have dreamed of up to the present time, and that in the future the scientific use of high-frequency currents will become the greatest method ever discovered for the healing of disease, the promotion of health and the maintenance of a "*More Abundant Life!*"

EXPERIMENTAL PHYSICS.

(*Continued from page* 106)

goes out solidly, so that now our siphon has its "arms" filled and acts the same as the ordinary siphon.

EXPERIMENT 28—The following is an interesting and amusing experiment. It can be made to appear mysterious, and is important because in it lies the principle of the submarine. In Fig. 24-A, 3 is a jar or other cylindrical glass vessel about two-thirds full of water. 2, is a small, light glass bottle, or better, a small glass vial. 1, is a piece of sheet rubber stretched over the top of the jar. Before placing 1 in position, vial 2 is partly filled with water and inverted so that it just floats upright. On pushing down on the sheet rubber the vial (Cartesian diver) sinks and on releasing it rises again. When we push down on the sheet rubber, we compress the air in the jar and hence it forces more water into the vial. Since it was originally adjusted so that it just floated, the addition of more water into the vial makes it heavier and hence it sinks. On releasing the sheet rubber the pressure in the jar becomes normal again, and hence the pressure in the vial causes the excess water to come out and the vial returns to its original position. Fig. 24-B, shows a more mystifying form of the same experiment. 3, is a Florence flask, while 2, is the same vial adjusted exactly as in Fig. 24-A. 1, is an ordinary cork stopper. After the vial is adjusted, the stopper is put in carefully. (It may be necessary to adjust the vial so that it floats *almost upright* so that on pushing in the stopper, a little more water enters the vial and it just floats upright.) On holding the flask in the hand it is found that one can, by squeezing it, compress the air and make the diver perform. Thus one can make the diver obey one's command to rise or sink, without the audience perceiving the cause. Obviously a thin flask which will yield to squeezing is necessary for this experiment and the ordinary Florence flask answers the purpose very well. The real submarine boat is so constructed that no water can enter it, even if it is wholly submerged, except at the will of the occupants. It is able to float like any other ship just as our vial can float. If the occupants wish the boat to submerge, water is allowed to enter into special compartments until the weight of the boat slightly exceeds the weight of